Title: **Investigating Bedrock Groundwater Recharge Dynamics in Mountainous Watersheds**

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Project Abstract:

We are investigating the effect of orographic micrometerology and shallow soil flow on deep bedrock groundwater recharge and discharge in upland catchments, to determine the dominant physical processes controlling their interaction in space and time. Accurate estimates of current and future water budgets will require knowledge of the relative volume water in surface, soil and deep groundwater, and their connections within a watershed. By far, the least understood reservoir in upland catchments is the deep groundwater system, which is complicated by high slope angles and complex topography and geology. We are measuring hydrologic connection of soil and deep groundwater with coupled shallow soil (<2 m) and deep groundwater (> 5 m) well nests on upland hill slopes, installed across a variety of landscape positions and climatic regimes, in watersheds dominated by differing lithology in northwestern Montana. Soil moisture, saturated water level, temperature and conductivity are monitored in soil and groundwater wells. Chemical and isotopic signatures are being collected and will be used to constrain fluid flux, age and provenance. Relationships between recharge flux, landscape position, local micro-climate, bedrock and soil material properties are being interpreted using our field datasets along with full Richards' equation numerical modeling of hillslope flow and transport. *We hypothesize that fundamental relationships between local climate, topography, landscape position, soil and bedrock properties exist that describe the location and amount of bedrock recharge and discharge in upland catchments*, and that by measuring these variables as well as soil and bedrock connection across a broad range of climatic, topographic and lithologic characteristics we can derive relationships which are broadly transferable to other systems. We are looking to expand the geographic and spatial scale of our sampling and data integration and interpretation methods in order to extend the range of applicability, by comparing our Montana watershed results with those of the Watershed Function Science Focus Area in the East River watershed, Colorado.